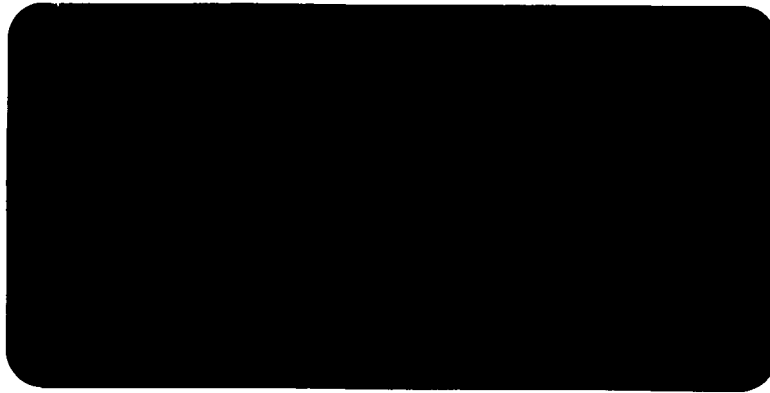


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ANALYSIS AND FIFTEEN-YEAR PROJECTION
OF THE
MARKET FOR LANDSAT DATA

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SECTION 1. INTRODUCTION

The Office of Space and Terrestrial Applications, Technology Transfer Division, was requested by the NASA Administrator's Office to provide information on the demand (or market) for Landsat-type products over the next 15 years. That information was prepared and presented to NASA by OAO Corporation on August 21, 1981.

This report constitutes the economic study that was performed to determine the potential market for Landsat products through the 1990's. It documents the constraints placed on the study, the assumptions made in the economic model, the data and methodology used, and the final results which were presented to the Technology Transfer Division.

This study was conducted under Task #49, Contract NASW3358, and is the final deliverable of that task. The work was performed by the OAO Management Advisory Services group under the direction of Russell Smith, assisted by F. Hawkins, T. Austin, and E. Porter of the OAO Aerospace Division and with consulting services from ECOsystems International, Inc. of Gambrills, Maryland. Technical Monitor for this task is J. Weber, NASA/OSTA, Code ETS-6.

SECTION 2. STUDY CONSTRAINTS

Time was a critical constraint in the performance of this study. A presentation of the results was required within two days of the task's inception. Consequently, the study used existing data, providing OSTA with justifiable results which they could use in the time frame allowed.

Additional ground rules were specified for the format in which the study results were categorized and presented. These additional constraints are as follows:

- a. The potential market for Landsat-type products would be presented in terms of Landsat "scenes" or "frames" which would be purchased.
- b. These scenes would be further classified by product type, either imagery or computer compatible tape (CCT).
- c. The future demand for Landsat products would be projected for the following user sectors: international; federal; state and local; academic; and private.
- d. The future demand for Landsat would also be categorized according to end uses or applications as follows: agriculture/range/forestry; minerals/energy resources; hydrology/water resources; health/environment; marine/oceans; land use/cartography; and national defense.

SECTION 3. STUDY METHODOLOGY

The study methodology involved three basic steps: first, to prepare baseline data; second, to determine quantitative extrapolation factors; and three, actually to perform the extrapolation and determine the study results.

Baseline data were obtained from Reference 1, which is a record of actual sales data from EROS Data Center. These data required manipulation, using References 2 and 3, to conform to the user sector/application classification needed for the study. The manipulations performed are described in subsections 3.1 and 3.2.

Quantitative measures of the future demand for Landsat products were based on two assumptions: expected improvements in the Landsat system and competition from planned comparable systems. The growth factors due to system improvements were determined from user requirements studies and surveys (References 2, 3, and 4). Competition from other systems was included as gross adjustments.

The extrapolation results are presented in Section 4.

3.1 ESTABLISHING A BASE YEAR

Establishing a base from which to extrapolate future demand was a critical step in producing a credible analysis. This base should be related to some measure of actual demand for products. Sales figures for Landsat image and tape products from the EROS Data Center (Reference 1) were available and are the most reliable representation of real demand for Landsat products.

While the EROS Data Center figures were used to establish a base year, two factors do make them a conservative measure of demand. First, some Landsat products are provided to the user community (primarily Federal agencies) by special arrangement from Goddard Space Flight Center without being sold through EROS. Second, some Landsat data are collected and sold to a variety of users by foreign receiving stations. However, these two sources of Landsat data were considered small in comparison to the EROS Data

Center. Therefore, the EROS sales data were not prorated to account for the greater actual demand for products satisfied by these other sources. Adjusting the EROS information by some factor may produce a more realistic estimate of actual demand.

The EROS sales figures for 1979 were selected as the baseline Landsat market. The EROS annual figures given in Reference 1 showed an overall decline in sales from 1976 to 1980 which most likely corresponded to a reduction in government-sponsored research activities. Sales appeared to level off at the end of that period, indicating a stabilized level of demand in 1979. In addition, 1979 was the most recent year for which complete figures were available; thus, its figures were selected as the base year.

In addition to providing a base year sales level, these figures were used to calculate a "unit price" factor from the total number of CCT and image products sold, and total revenues. This factor represents the weighted average price of each product and will be used later to calculate the dollar value of future product demand projections. Two assumptions should be noted with regard to this "unit price" factor. First, the ratio of image to CCT products is assumed to remain constant over time and that the 1979 base data satisfactorily represents that ratio. Second, the price factor was not adjusted to reflect future price changes. This assumption is likely to be conservative in that product prices could increase by an order of magnitude within the time frame covered in the study. However, no reliable information was available on which to base future price increases.

3.2 CORRELATING REFERENCE INFORMATION WITH STUDY REQUIREMENTS

In several ways the information provided in References 1-7 had to be adapted to meet the study requirements in terms of user sectors, application categories, data timeliness and resolution. In some cases, gaps existed such that extrapolations had to be performed; in other cases more detailed information was available than required such that figures had to

be combined or adjusted to produce consistent results. Sometimes information from two or more sources had to be integrated to achieve results in the required format. Some of these adaptations are discussed below.

The EROS Data Center sales figures for 1979 which were used to establish an annual demand base could be divided into the five user categories as specified for this study. (The EROS categories "Industrial" and "Individual" were combined to form the category "Private" for this study.) However, the EROS figures did not give the demand for products by application category as required for this study. The breakdown of demand by the application categories requested by NASA was determined from References 2 and 3. Table 3-1 lists the seven applications categories specified by NASA for this study, with each category numbered. Tables 3-2 and 3-3 list the categories provided in References 2 and 3, respectively, with the number of the NASA-specified category to which each corresponds.

Table 3-1. Application Categories Specified by NASA for this Study

NASA Application Category	
1	Agriculture/Range/Forestry
2	Minerals/Energy Resources
3	Hydrology/Water Resources
4	Health/Environment
5	Marine/Oceans
6	Land Use/Cartography
7	National Defense

Reference 3 was used to determine the demand for products by application for the federal and foreign user sectors. The federal sector information was provided by a survey of only USDA, DOI, and U.S. Army C.O.E. These agencies' requirements were assumed to reflect the need for products proportionately by application for the federal sector as a whole. The international (foreign) sector demand for products was formed by combining the demand stated in reference 3 for both the foreign private and foreign governmental arenas.

Table 3-2. Application Categories (Reference 2) Matched to Specified Categories

NASA	Application Category	NASA	Application Category
6	Land Change	3	Wetlands
6	Land Class	3	Drainage
1	Forest Inventory	1	Soil Class
2	Geology St.	2	Geobotanic
4	Wildlife Inventory	2	Topography
4	Environmental Department	1	Agriculture Evaluation
1	Range Inventory	1	Forest Evaluation
1	Crop Division	1	Forest Condition
1	Crop Inventory	5	CZM
2	Landforms	2	Magnetic
2	Lithology	2	Gravity
4	Water Level	1	Crop Condition
3	Inland Water	1	Other Renew
4	Wildlife Evaluation	1	Soil Moisture
2	Thermal		

Table 3-3. Application Categories (Reference 3) Matched to Specified Categories

NASA	Application Category	NASA	Application Category
1	Crops	2	Geology
1	Soils	3	Hydrology
1	Forest	4	Wildlife
1	Range	6	Land Use

Reference 2 was used to determine the proportionate demand for products by application in the state and local, academic, and private sectors. This source was used because it provided the most recent data available for these sectors.

The application category National Defense was the only one of the seven examined which was not discussed in References 2 and 3. This category, which was assumed to be of interest only to the federal user sector, refers primarily to the measurement and inventory of renewable resources for defense purposes. Based upon information from References 5 and 6, it was estimated that National Defense requirements would be 15% of those for the Agriculture/Range/Forestry applications. This figure, which accounted for about 6% of the total federal sector demand, was added to the EROS' 1979 base sales information because it was assumed to be absent from the normal sales information.

3.3 EXTRAPOLATION OF BASELINE MARKET TO FUTURE MARKET

The 1979 base year sales information provides the basis for extrapolating future demand for Landsat products. Two factors were recognized which will have significant impact on this demand in the future. The first is more timely delivery of data from the satellite to the user community. Based upon the plans for Landsat D, it was assumed that the data delivery time would be reduced to one week in 1985. By improving delivery time, the demand for products will theoretically increase, since the requirements of more time-critical applications can now be met. This increase in demand is substantiated by Reference 4, in which the percentage of requirements that can be met by various data delivery times is presented for some applications. Assuming a seven-day delivery time, growth factors were determined for the various applications whose requirements are met by the increased system capability. These factors, which were applied to the 1979 base to produce the 1985 demand, are shown in Table 3-4. This 1985 projection is based upon the current Landsat resolution of 80 meters and the projected seven day data delivery time.

Table 3-4. Growth Factors to Adjust the Base Year Demand Due to Seven Day Data Availability (Extrapolation from Reference 4, Page 42)

	Percent of Present Market	Percent of Seven Day Delivery Market	Growth Factor
Agriculture	25	35	1.37*
Forestry	75	85	
Mineral & Energy	95	95	1.00
Hydro & Water	40	60	1.50
Marine	50	60	1.20
Cartography	95	95	1.00
Health & Education	40	60	1.50
National Defense	60	82	1.37

*Separate time use factors were used for agriculture and forestry. These were weighted by % use and combined. The forestry-agriculture breakdown was not for current base so the total was adjusted by use factor.

The second factor which will have significant impact in the future demand for Landsat products is increased resolution. Just as timely data delivery provided the basis for projecting increased demand in 1985, improvements in data resolution are likely to increase demand further after 1985. Based upon projections for future land remote sensing systems, it was assumed that 30 meter resolution would be achieved by 1990 and 10 meter resolution by 1995*.

While these assumptions may seem arbitrary, they are reasonable estimates of times at which significant utilization of data at these resolutions will occur. Although data at 30 and 10 meter resolution are scheduled to be available well before 1990 and 1995, respectively, the demand for them is likely to begin at a low level and gradually increase as the necessary capabilities and techniques for data processing and analysis are developed. Thus, the increase in demand for products during the five year

intervals, (i.e., 1985 to 1990 and 1990 to 1995) will be gradual rather than a drastic increase at the end of each interval.

Making this higher resolution data available in addition to nominal 80 meter data, the demand for Landsat products will increase as evidenced by the user community requirements presented in Reference 3. These requirements are presented for the user sectors being examined in this study as well as for various applications, which can be cross-referenced with Table 3-3 to fit the seven applications of this study. Using the Reference 3 information on user requirements for data at nominal (80 meter) and higher resolutions (30 and 10 meter), ratios were established to project the increased demand for data as resolution increased. In this way, the 1985 demand was extrapolated to 1990 and 1995, when the higher resolution data was assumed to be available.

Two additional assumptions should be noted concerning the extrapolation of future demand for products. The first is that data delivery was assumed to remain at seven days through 1995. Data delivery times may in fact improve over that time period so that the estimates for future product demand are somewhat conservative since demand should increase with improved timeliness. The second assumption is that competition from foreign satellite systems will have a significant impact on the foreign user demand for U.S. satellite products. The French SPOT system was assumed to be satisfying one-half of the demand of the foreign user community in 1990. In the 1995 time frame the Japanese MOS system would combine with SPOT to capture two-thirds of the foreign market. The foreign sector demand projections for 1990 and 1995 have been adjusted to reflect these reductions.

SECTION 4. RESULTS

As stated in Section 1, the purpose of this study was to project the future demand for Landsat products over the next two decades. The most effective format for presenting these results is in matrix form. A series of matrices which contain the study results are presented below.

4.1 BASE YEAR MATRICES

The baseline sales of data for 1979, obtained primarily from the EROS sales data, are tabulated in Tables 4-1 and 4-2. Table 4-1 gives simply the unadorned sales data, separated into the required user/application categories by the method described in subsection 3.2. Table 4-2 relates the various subtotals by including percentages, as well as pinpointing references which substantiate the user/application classifications used.

4.2 1985 PROJECTION

The 1985 market projection is based upon the increased utilization expected from an improvement in data delivery time from the current 60-90 days to seven days. In Table 4-3 are the growth factors, with the projected number of data products (frames or CCT) to be sold and the equivalent dollars, per user/application category. The growth factors reflect the assumption that application class, rather than user type, is the driving factor in the utilization of data, particularly at this stage of the projection, which includes only the improvement in data delivery time.

4.3 1990 PROJECTION

The 1990 projection in Table 4-4 includes the seven-day data delivery time, 30-meter resolution, and the competition from the French land remote-sensing system. The inclusion of all three of these items lead to less uniformity in the growth factor between user sectors. A noticeable effect is in the international user market, which in almost all cases decreases. However, the improved resolution increases the market in nearly every other category so that the total market has increased.

4.4 1995 PROJECTION

Table 4-5 gives the projected market in 1995, which includes, besides the seven-day delivery time and the French competition, a new improvement in resolution to 10 meters and the Japanese land remote-sensing system. The results are significant increases for most users in the agriculture, cartography, and national defense applications, but much smaller increases or even decreases for the international user sector.

4.5 COMPOSITE FIFTEEN-YEAR PROJECTION

In Figure 4-1 and Figure 4-2 are the cumulative market data by user sector and by application class. From these graphs it is clear that improved resolution is a major factor in the marketability of Landsat data, the 10-meter resolution in particular having a significant impact on the federal, private, and international user, and on the agriculture, minerals, and national defense applications.

USER APPLICATION	FEDERAL		STATE & LOCAL		ACADEMIC		PRIVATE		INTERNATIONAL		TOTAL	
	TOT. UNITS FR/CCT	\$	TOT. UNITS FR/CCT	\$	TOT. UNITS FR/CCT	\$	TOT. UNITS FR/CCT	\$	TOT. UNITS FR/CCT	\$	TOT. UNITS FR/CCT	\$
AGRICULTURE/FORESTRY/RANGE	13,514 13,217 297	216,224	175 170 5	2,800	6,634 6,451 183	106,144	5,272 5,152 120	84,352	12,400 12,163 237	198,400	37,995 37,152 842	606,160
MINERALS/ENERGY	5,891 5,761 130	94,256	155 151 4	2,480	1,622 1,577 45	25,952	25,308 24,731 577	404,928	16,173 15,864 309	258,769	49,149 48,084 1,065	786,384
HYDROLOGY/WATER RESOURCES	7,970 7,795 175	127,520	116 113 3	1,840	589 573 16	9,424	0 0 0	0	7,547 7,403 144	120,752	16,222 15,884 338	239,552
MARINE/OCEANS	0 0 0	0	29 28 1	464	1,769 1,720 49	28,364	0 0 0	0	3,774 3,702 72	60,324	5,572 5,450 122	89,152
CARTOGRAPHY/LAND USE	2,080 2,034 46	33,280	262 255 7	4,192	0 0 0	0	2,109 2,061 48	33,744	3,774 3,702 72	60,384	8,225 8,052 173	131,600
HEALTH/ENVIRONMENT	3,119 3,050 69	49,904	232 226 6	3,712	4,128 4,014 114	66,048	2,460 2,404 56	39,360	10,243 10,047 196	163,888	20,182 19,741 441	322,912
NATIONAL DEFENSE	2,080 2,034 46	33,280	0 0 0	0	0 0 0	0	0 0 0	0	0 0 0	0	2,080 2,034 46	33,280
TOTAL	34,654 33,891 762	554,464	969 943 25	15,488	14,742 14,336 406	235,932	35,149 34,349 801	562,384	53,911 52,881 1,031	862,517	139,425 136,400 3,025	2,230,785

SOURCE #1 (CONSUMER PROFILES LANDSAT IMAGERY, OCTOBER 23, 1979 AND CCT CONSUMER PROFILE OCTOBER 10, 1980 FOR FY 1979)

Table 4-1. 1979 Base Data

USER APPLICATION	FEDERAL			STATE & LOCAL			ACADEMIC			PRIVATE			INTERNATIONAL			TOTAL
	REF	%*	FR/CCT	REF	%**	FR/CCT	REF	%**	FR/CCT	REF	%**	FR/CCT	REF	%*	FR/CCT	
AGRICULTURE/FORESTRY/RANGE	3,5,6	39	$\frac{13,217}{297}$	2,5	18	$\frac{170}{5}$	2,5	45	$\frac{6,451}{183}$	2,5,7	15	$\frac{5,152}{120}$	3,7	23	$\frac{12,163}{237}$	$\frac{37,153}{842}$
MINERALS/ENERGY	3,5,6	17	$\frac{5,761}{130}$	2,5	16	$\frac{151}{4}$	2,5	11	$\frac{1,577}{43}$	2,5,7	72	$\frac{24,731}{577}$	3,7	30	$\frac{15,864}{309}$	$\frac{48,084}{1,065}$
HYDROLOGY/WATER RESOURCES	3,5,6	23	$\frac{7,795}{175}$	2,5	12	$\frac{113}{3}$	2,5	4	$\frac{573}{16}$	—	0	0	3,7	14	$\frac{7,403}{144}$	$\frac{15,884}{338}$
MARINE/OCEANS	—	0	0	2,5	3	$\frac{28}{1}$	2,5	12	$\frac{1,720}{49}$	—	0	0	3	7	$\frac{3,702}{72}$	$\frac{5,450}{122}$
CARTOGRAPHY/LAND USE	3,5,6,7	6	$\frac{2,034}{46}$	2,5,7	27	$\frac{255}{7}$	2,5	0	0	5,7	6	$\frac{2,061}{48}$	3,7	7	$\frac{3,702}{72}$	$\frac{8,052}{173}$
HEALTH/ENVIRONMENT	3,5,6	9	$\frac{3,050}{69}$	2,5	24	$\frac{226}{6}$	2,5	28	$\frac{4,014}{114}$	2,5	7	$\frac{2,404}{56}$	3	19	$\frac{10,047}{196}$	$\frac{19,741}{441}$
NATIONAL DEFENSE	5,6	6	$\frac{2,034}{46}$	—	0	0	2,5	0	0	—	0	0	—	0	0	$\frac{2,034}{46}$
TOTAL ***		100	$\frac{32,891}{762}$		100	$\frac{943}{25}$		100	$\frac{14,336}{406}$		100	$\frac{34,349}{801}$		100	$\frac{52,681}{1,031}$	$\frac{136,400}{3,025}$

* SOURCE 3

** SOURCE 2 STATE & LOCAL PG.6, ACADEMIC PG.8, PRIVATE PG.7, AND SEE WORK SHEETS.

*** SOURCE 1 CONSUMER PROFILE OF LANDSAT IMAGERY FY 79 OCTOBER 10, 1980 (TOTAL INCREASED BY 6% AND THEN NORMALIZED TO OBTAIN NEW DATA), AND CCT CUSTOMER PROFILE FY 79, OCTOBER 10, 1980.

NOTES

- ABOVE LISTED REFERENCES (REF) CONTAINED INFORMATION THAT SUBSTANTIALLY ILLUSTRATED THE USERS' APPLICATION.
- THE NUMBER OF FR/CCT, WERE ROUNDED TO THE NEAREST UNIT.

Table 4-2. Percentage and Pro-Rated Number (1979) of Landsat Products by Application within each User Category

USER APPLICATION	FEDERAL			STATE & LOCAL			ACADEMIC			PRIVATE			INTERNATIONAL			TOTAL		
	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	TOT. UNIT FR/CCT	\$	
AGRICULTURE/FORESTRY/RANGE	1.37	18,514 18,107 407	296,224	1.37	240 234 6	3,840	1.37	9,089 8,838 251	145,424	1.37	7,223 7,058 164	115,568	1.37	16,988 16,663 325	271,808	52,053 50,899 1,153	832,864	
MINERALS/ENERGY	1.0	5,891 5,761 130	94,256	1.0	155 151 4	2,480	1.0	1,622 1,577 45	25,952	1.0	25,308 24,731 577	404,928	1.0	16,173 15,864 309	258,769	49,149 48,084 1,065	786,385	
HYDROLOGY/WATER RESOURCES	1.5	11,955 11,692 263	191,280	1.5	174 169 5	2,784	1.5	884 860 24	14,144	1.5	0 0 0	0	1.5	11,321 11,105 216	181,136	24,333 23,825 508	389,344	
MARINE/OCEANS	1.2	0 0 0	0	1.2	35 34 1	560	1.2	2,123 2,064 59	33,968	1.2	0 0 0	0	1.2	4,529 4,442 86	72,464	6,686 6,540 146	106,992	
CARTOGRAPHY/LAND USE	1.0	2,080 2,034 46	33,280	1.0	262 255 7	4,192	1.0	0 0 0	0	1.0	2,109 2,061 48	33,744	1.0	3,774 3,702 72	60,384	8,225 8,052 173	131,600	
HEALTH/ENVIRONMENT	1.5	4,679 4,576 103	74,864	1.5	348 339 9	5,568	1.5	6,192 6,021 171	99,072	1.5	3,690 3,606 84	59,040	1.5	15,365 15,071 294	245,840	30,274 29,613 661	484,384	
NATIONAL DEFENSE	1.37	2,850 2,787 63	45,600	1.37	0 0 0	0	1.37	0 0 0	0	1.37	0 0 0	0	1.37	0 0 0	0	2,050 2,787 63	45,600	
TOTAL		45,969 44,957 1,012	735,504		1,214 1,182 32	19,424		19,910 19,360 550	318,560		38,330 37,448 882	613,280		68,150 66,855 1,295	1,090,401	173,569 169,799 3,770	2,777,169	

Table 4-3. 1985 Landsat Market Projection (based on seven-day delivery time)

USER APPLICATION	FEDERAL			STATE & LOCAL			ACADEMIC			PRIVATE			INTERNATIONAL			TOTAL	
	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR*	TOT. UNIT FR/CCT	\$	TOT. UNIT FR/CCT	\$
AGRICULTURE/FORESTRY/RANGE	2.76	51,099	817,584	2.88	691	11,056	2.76	25,086	401,376	3.83	27,664	442,624	$\frac{1.68}{2}$	14,270	228,320	118,810	1,900,960
		49,975			673			24,384			27,028			13,999		116,059	
		1,124			18			702			636			271		2,751	
MINERALS/ENERGY	3.22	18,969	303,504	2.00	310	4,960	3.22	5,223	83,568	2.02	51,122	817,952	$\frac{1.69}{2}$	13,666	218,656	89,290	1,428,640
		18,552			302			5,077			49,946			13,406		87,283	
		417			8			146			1,176			260		2,007	
HYDROLOGY/WATER RESOURCES	1.52	18,172	290,752	3.00	522	8,352	1.52	1,344	21,504		0	0	$\frac{3.00}{2}$	16,982	271,712	37,020	592,320
		17,772			508			1,306			0			16,659		36,245	
		400			14			38			0			323		775	
MARINE/OCEANS	1.0	0	0	1.0	35	560	1.00	2,123	33,968		0	0	$\frac{1.0}{2}$	2,265	36,240	4,423	70,768
		0			34			2,064			0			2,221		4,319	
					1			59						44		104	
CARTOGRAPHY/LAND USE	1.57	3,266	52,256	1.50	393	6,288	1.57	0	0	1.0	2,109	33,744	$\frac{2.14}{2}$	4,038	64,608	9,806	156,896
		3,194			383			0			2,061			3,961		9,599	
		72			10						48			77		207	
HEALTH/ENVIRONMENT	1.30	6,083	97,328	2.50	870	13,920	1.30	8,050	128,800	1.0	3,690	59,040	$\frac{2.00}{2}$	15,365	245,840	34,058	544,928
		5,949			847			7,825			3,606			15,073		33,300	
		134			23			225			84			292		758	
NATIONAL DEFENSE	2.83	8,066	129,056	—	—	0	—	—	0	—	—	0	—	—	0	8,066	129,056
		7,889			—			—			7,889			177		177	
		105,655			2,821			41,826			84,585			66,586		301,473	
TOTAL		103,331	1,690,480		2,748	45,136		40,656	669,216		82,640	1,353,360		65,319	1,065,376	294,694	4,823,568
		2,324			73			1,170			1,945			1,267		6,779	

*ADDITIONAL 50% ADJUSTMENT IN ANTICIPATION OF FRENCH COMPETITION IN THE INTERNATIONAL MARKET.

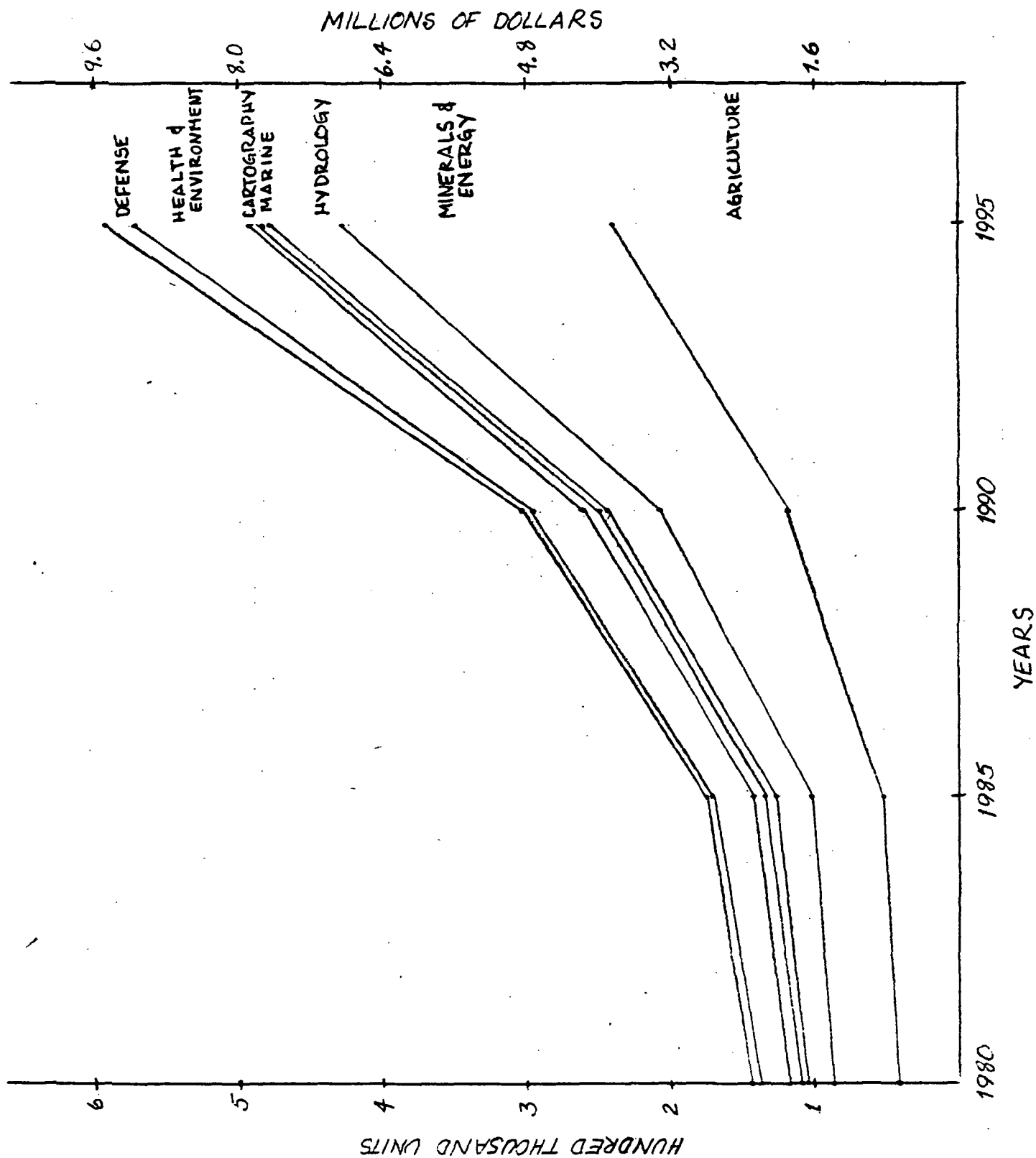
Table 4-4. 1990 Landsat Market Projection (based on 30-m resolution)

USER APPLICATION	FEDERAL			STATE & LOCAL			ACADEMIC			PRIVATE			INTERNATIONAL			TOTAL	
	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR	TOT. UNIT FR/CCT	\$	FACTOR*	TOT. UNIT FR/CCT	\$	TOT. UNIT FR/CCT	\$
AGRICULTURE/FORESTRY/RANGE	6.61	122,378 119,686 2,692	1,958,048	2.88	691 673 18	11,056	6.61	60,078 58,395 1,682	961,248	5.0	36,150 35,319 831	578,400	3.63 3	20,555 20,164 391	328,880	239,852 234,238 5,614	3,837,632
MINERALS/ENERGY	3.28	19,322 18,897 425	309,152	2.0	310 302 8	4,960	3.28	5,320 5,121 149	83,120	5.19	131,349 128,328 3,021	2,101,584	5.45 3	29,381 28,823 558	470,096	185,682 181,521 4,161	2,968,912
HYDROLOGY/WATER RESOURCES	2.48	29,648 28,996 652	474,368	3.33	579 564 15	9,264	2.48	2,192 2,131 61	33,072	1.0	0 0 0	0	4.6 3	17,359 17,029 330	377,744	49,778 48,720 1,058	894,448
MARINE/OCEANS	1.0	0 0 0	0	1.0	35 34 1	560	1.0	2,123 2,064 59	33,968	1.0	0 0 0	0	1.0 3	1,510 1,481 29	24,160	3,668 3,579 89	58,688
CARTOGRAPHY/LAND USE	4.43	9,214 9,011 203	147,424	3.0	786 766 20	12,576	4.4	0 0 0	0	1.0	2,109 2,060 49	33,744	2.14 3	2,692 2,641 51	43,072	14,801 14,478 323	236,816
HEALTH/ENVIRONMENT	1.30	6,083 5,949 134	97,328	2.50	670 847 23	13,920	1.30	8,050 7,825 225	128,800	1.0	3,690 3,605 85	59,040	12.0 3	61,460 60,292 1,168	983,360	80,153 78,518 1,635	1,282,448
NATIONAL DEFENSE	6.83	19,466 19,038 428	311,456	—	— — —	0	—	— — —	0	—	— — —	0	0 3	— — —	0	19,466 19,038 428	311,456
TOTAL		206,111 201,577 4,534	3,297,776		3,271 3,186 85	52,336		77,763 75,582 2,176	1,240,208		173,298 169,312 3,986	2,772,768		132,957 130,430 2,527	2,227,312	593,400 580,092 13,308	9,590,400

*ADDITIONAL 67% ADJUSTMENT IN ANTICIPATION OF FRENCH AND JAPANESE COMPETITION

Table 4-5. 1995 Landsat Market Projection (based on 10-m resolution)

Figure 4-1. Fifteen-Year Landsat Market Projection-Sales by Year by Application



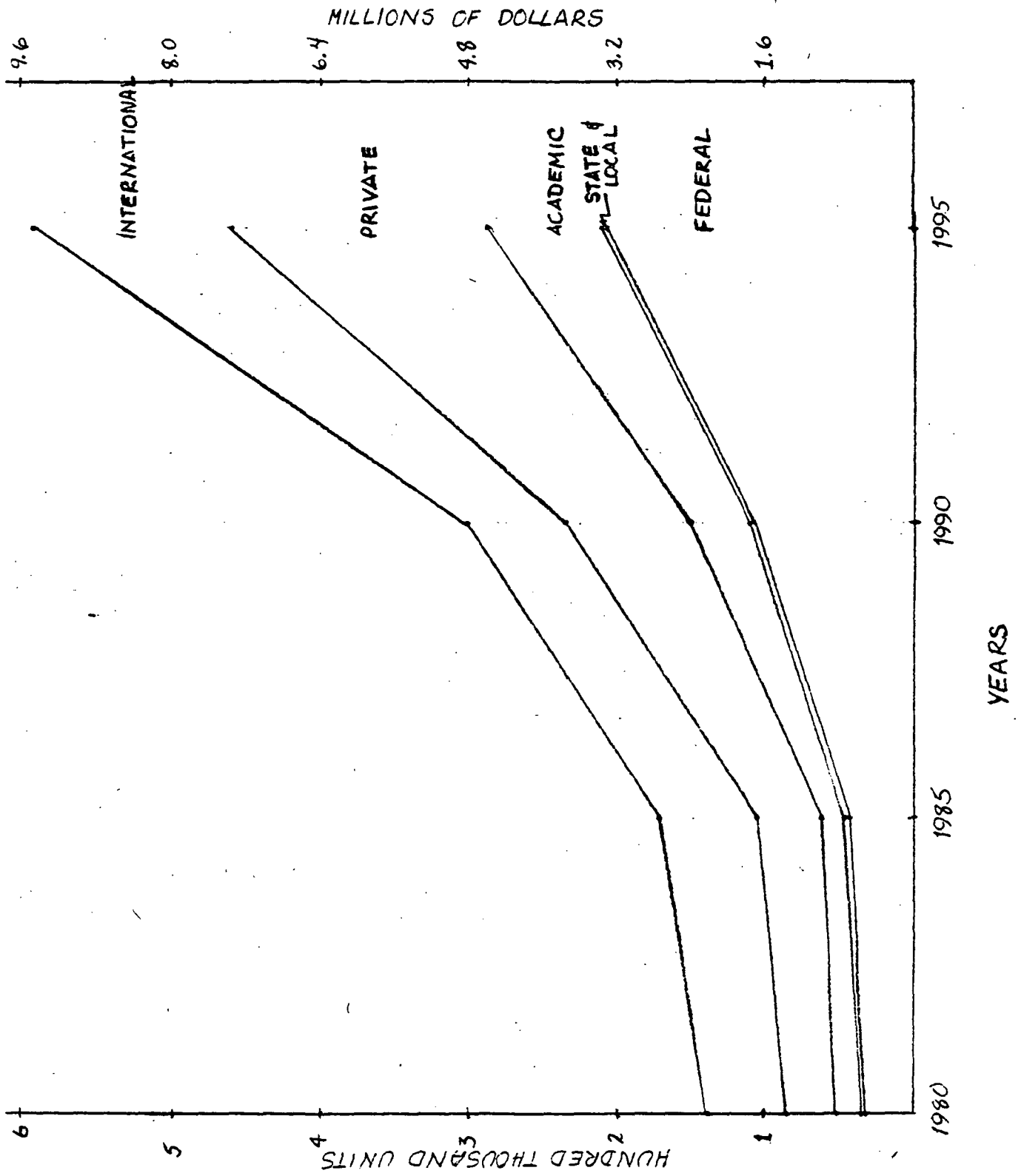


Figure 4-2. Fifteen-year Landsat Market Projection-Sales by Year by User

SECTION 5. REFERENCES

The reference materials which were selected for use in this study are listed below with a brief description of the information contained in each.

References

- 1 Customer Profile of Landsat Imagery (FY73-Fy79) and CCT (FY75-FY80) purchases; EROS Data Center; October 10 & 23, 1980.
Contains information on number of frames/scenes sold and their dollar value by user categories for each fiscal year.
- 2 "An Analysis of User Requirements for Operational Land Satellite Data"; G. Williams Spann, Nancy J. Hooper, Metrics, Inc. and David J. Cotter, NOAA; presented 15th International Symposium on Remote Sensing of Environment, Ann Arbor, MI; May 1981.
Illustrates graphically the data derived from an analysis of user requirements for an operational land satellite data. These requirements were expressed in questionnaires returned to NOAA after the March, 1980, series of conferences on the U.S. operational land remote sensing satellite system.
- 3 "Chapter 2 - Working - User Requirements"; unpublished report prepared by NOAA to supplement the NASA/NOAA transition plan; circa May 1980.
The data requirements for an operational land remote sensing system are discussed along with a summary of the needs of the USDA, USDOl, USCOE, state and local governments, and domestic private sector.
- 4 "Planning for a Civil Operational Land Remote Sensing Satellite System: A Discussion of Issues and Options"; NOAA, U.S. Department of Commerce; June 20, 1980.

This document discusses the issues involved in implementing an operational land remote sensing system from space, initially based on Landsat technology, with the goal of eventual private sector ownership and operation. Some policy and technical options related to implementing an operational system are included.

- 5 "Landsat Follow-On: A Report by the Applications Survey Groups - Discipline Discussions"; Technical Memorandum 33-803, Volume II; NASA, Jet Propulsion Laboratory; December 15, 1976.
- 6 "A Summary of the Users Perspective of Landsat-D and Reference Document of Landsat Users"; prepared by Office of User Affairs.
- 7 "Analysis of the Private Market for Landsat Products and Applications - Final Report"; for OSTA, NASA Headquarters by OAO Corporation; March 31, 1981.
Study analyzes the U.S. private market arena and identifies potential private users of Landsat technology. Recommendations are made for involving cooperative activities between NASA and the private sector.

